

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平9-314861

(43) 公開日 平成9年(1997)12月9日

(51) IntCl. <sup>6</sup>	識別記号	庁内整理番号	F I	技術表示箇所
B 4 1 J	2/175		B 4 1 J	3/04
	2/05			1 0 2 Z
				1 0 3 B

審査請求 未請求 請求項の数9 OL (全 6 頁)

(21) 出願番号 特願平8-141323

(22) 出願日 平成8年(1996)6月4日

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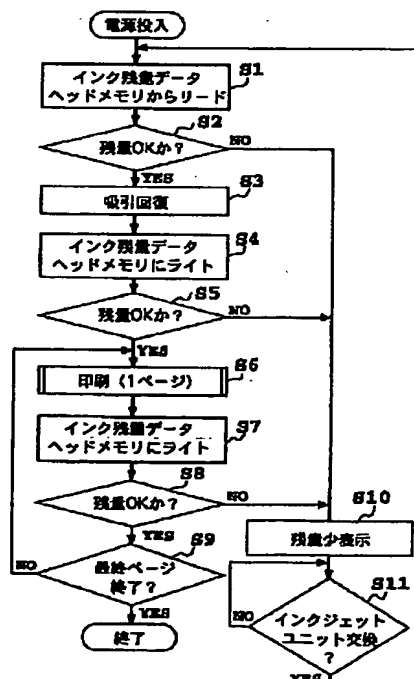
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(54) 【発明の名称】 インクジェット記録装置およびインクジェットユニット

(57) 【要約】

【課題】 インクジェット記録装置におけるインク残量検知のための構成を、簡易でかつ低コストなものとする。

【解決手段】 インクジェットヘッド内にインク残量に関するデータを格納するメモリを設け、装置の電源投入時に上記メモリからインク残量データを読み取り（ステップS1）、残量検知用のデータとする。そして吸引回復（ステップS3）や印刷（ステップS6）を行うごとにそれらの処理で消費したインク量を上記インク残量データが示す値から減算し、その結果を新たな残量データとするとともにヘッド内の上記メモリにそのデータを書き込む（ステップS4、S7）。以上のようにして得られるインク残量データが所定値以下となった場合、インク残量が少ない旨の表示を行う（ステップS10）。



## 【特許請求の範囲】

【請求項 1】 メモリを有したヘッドと該ヘッドに供給するインクを貯留したインクタンクとを一体に形成したインクジェットユニットを用い、前記ヘッドからインクを吐出して記録を行うインクジェット記録装置において、

ヘッドが有するメモリに対し、インク消費に関するデータの書き込みまたは読み取りを行うリード・ライト手段と、

該リード・ライト手段が前記メモリから読み出したインク消費に関するデータに基づき、インクタンクにおけるインク残量を検知する残量検知手段と、

を具えたことを特徴とするインクジェット記録装置。

【請求項 2】 前記インク消費に関するデータは、インク吐出回数および吸引回復処理の回数であり、前記リード・ライト手段は、前記インク吐出回数および吸引回復処理の回数の累積値を前記メモリに書き込むことを特徴とする請求項 1 に記載のインクジェット記録装置。

【請求項 3】 前記リード・ライト手段は、所定量の記録動作または吸引回復処理が終了する毎に、前記メモリへの書き込みを行うことを特徴とする請求項 1 または 2 に記載のインクジェット記録装置。

【請求項 4】 前記インクジェット記録装置は、前記残量検知手段が、インク残量が所定量以下であることを検知したときは、残量が少ない旨の報知を行う報知手段をさらに具えたことを特徴とする請求項 1 ないし 3 のいずれかに記載のインクジェット記録装置。

【請求項 5】 前記メモリは、他の情報の格納のために共用されるものであることを特徴とする請求項 1 ないし 4 のいずれかに記載のインクジェット記録装置。

【請求項 6】 前記ヘッドは、熱エネルギーを利用してインクに気泡を生じさせ該気泡の生成に基づいてインクを吐出することを特徴とする請求項 1 ないし 5 のいずれかに記載のインクジェット記録装置。

【請求項 7】 インクジェット記録装置で用いられ、メモリを有したヘッドと該ヘッドに供給するインクを貯留したインクタンクとを一体に形成したインクジェットユニットにおいて、

前記メモリには、インクジェット記録装置で用いられるときに書き込みまたは読み取りが行われる、インク消費に関するデータが格納されたことを特徴とするインクジェットユニット。

【請求項 8】 前記インク消費に関するデータは、インク吐出回数および吸引回復処理の回数の累積値であることを特徴とする請求項 7 に記載のインクジェットユニット。

【請求項 9】 前記ヘッドは、熱エネルギーを利用してインクに気泡を生じさせ該気泡の生成に基づいてインクを吐出することを特徴とする請求項 7 または 8 に記載のインクジェットユニット。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、インクジェット記録装置およびインクジェットヘッドに関し、詳しくは、インクジェットヘッドに供給するインクを貯留するためのインクタンクにおけるインク残量を検知するための構成に関するものである。

## 【0002】

【従来の技術】従来より良く知られるインク残量検知のための構成は、インクタンク内に電極用の 2 本の針を挿入し、この 2 本の電極間のインク抵抗値を求めることにより、電極間のインクの有無を検出するものである。

【0003】図 1 はその従来例を示す模式図である。図において、3 2 はインクタンクを示し、その内部には吸収体が吸収されており、吸収体にはインク 3 1 が充填されている。1 対の電極 3 3 は、インクタンク 3 2 のケースをなす部材を貫いて設けられている。各電極 3 3 にはリード線が接続し、これにより記録装置本体における所定の電源、電流検知構成等により、図中、A、B で示す電極間に定電圧（もしくは定電流）を印加し、その時に生ずる A、B 間の電流（もしくは電圧）を検出してインク抵抗値を知り、それによって最終的にインク残量を求めるものである。

【0004】図 2 は上述した従来例に係るインク残量検知構成の等価回路を示す図である。電源 4 1 によって所定電圧が印加される電極 A、B 間にはインクの量に応じた抵抗値を示す抵抗  $R_i$  が存在し、その抵抗  $R_i$  の値をもってインク残量の判断を行うことができる。

## 【0005】

【発明が解決しようとする課題】しかしながら、上記従来例では、電極間に存在するインクの抵抗値を測定しているため、インクの種類によってその抵抗値が異なる場合、測定の結果得られる残量にばらつきを生じたり、また、電極用ピンを挿入することに起因したインクタンク組立上の種々の制約が生じることがある。さらに、抵抗値を求めるための抵抗測定回路が必要となり、ピンに関する構成と併せてコストが高くなることもあった。

【0006】本発明は、インク残量検知における上記問題点を鑑みてなされたものであり、その目的とするところは簡易な構成であり、かつ低コストのインク残量検知を可能とするインクジェット記録装置およびインクジェットユニットを提供することを目的とする。

## 【0007】

【課題を解決するための手段】そのために本発明では、メモリを有したヘッドと該ヘッドに供給するインクを貯留したインクタンクとを一体に形成したインクジェットユニットを用い、前記ヘッドからインクを吐出して記録を行うインクジェット記録装置において、ヘッドが有するメモリに対し、インク消費に関するデータの書き込み

または読み取りを行うリード・ライト手段と、該リード

・ライト手段が前記メモリから読み出したインク消費に関するデータに基づき、インクタンクにおけるインク残量を検知する残量検知手段と、を具えたことを特徴とする。

【0008】また、インクジェット記録装置で用いられ、メモリを有したヘッドと該ヘッドに供給するインクを貯留したインクタンクとを一体に形成したインクジェットユニットにおいて、前記メモリには、インクジェット記録装置で用いられるときに書き込みまたは読み取りが行われる、インク消費に関するデータが格納されたことを特徴とする。

【0009】以上の構成によれば、ヘッドが有するメモリに吐出回数等のインク消費に関するデータが格納されるので、このデータを読み取ることにより、インクタンクにおけるインクの残量に関する情報を得ることができる。

【0010】

【発明の実施の形態】以下、図面を参照して本発明の実施形態を詳細に説明する。

【0011】図3は本発明の一実施形態に係るインクジェットユニットの内部構成を示す模式図である。

【0012】図に示すように、インクジェットユニットはヘッド10とインクタンク14とを一体に形成したものであり、このユニットは、キャリアジ（不図示）に対し着脱自在に装着される。図において、11はメモリ素子であり、例えばEEPROMによって構成することができる。12はメモリ素子11が取付けられたPCB基板、13は複数の発熱抵抗体（不図示）がインク吐出口の数に対応して配設されたシリコン基板であり、シリコン基板13とPCB基板12はワイヤーボンディングにより電気的に接続されている。15はPCB基板12の端部に設けられヘッドと装置本体側との電気的接続を行うための端子であり、インクジェットユニットのキャリアジへの装着にともなって、キャリアジ上に設けられたコネクタと接続する。以上の各要素によってヘッド10が構成される。一方、インクタンク14は、ヘッド10に供給するインクを貯留するものである。

【0013】以上の構成において、ヘッド10内のメモリ素子11にはインク吐出の回数を示す駆動パルス数および、吸引回復処理の回数が書き込まれる。すなわち、ヘッド10で消費されるインク量に関する駆動パルス数等の累積値が記憶される。これにより、インクタンク14のインク残量を知ることができる。

【0014】なお、メモリ素子11は、インク残量検用に新たに設けてもよいが、例えばビット補正用にもともとヘッドが具えているメモリの空白部分を利用することもでき、これによりインク残量検知のためのコストの増加をさらに抑制することができる。

【0015】図4は記録（印刷）動作およびその動作に伴う上述の駆動パルス等、インク残量に関するデータ

のメモリ素子11に対する読み取り／書き込みの処理を示すフローチャートである。

【0016】本実施形態では、電源が投入されることにより処理が起動され、ステップS1で、装着されているインクジェットユニットのメモリ11内のデータを読み取り処理のRAM内に格納するとともにその読み取ったデータに基づいてインクタンク14内の現在のインク残量を示すデータを求める。すなわち、メモリ11から読み取った駆動パルス数および吸引回復動作の回数をそれらによって消費されるインク量に換算し、この値を予め知られているインクタンクの最初のインク量を示す値から減算することによりインク残量を知ることができる。次に、ステップS2において、上記求めたインク残量がある一定の値より以下か否かを判断する。

【0017】ここで、インク残量が一定値以上と判断した場合は、ステップS3で吸引回復動作を行い、ステップS4で、累積の吸引回復回数にステップS3で行った回数を加算し、その結果をヘッドのメモリ11に書き込む。すなわち、吸引回復を行うと一定の量インクが消費されるため、制御部の所定のRAM内にロードされてある残量データを更新するとともにそのデータをヘッド内のメモリ11に書き込むことを行う。次に、ステップS5で更新された残量データに基づき、ステップS2と同様のインク残量のチェックを行う。

【0018】ステップS5で、インク残量が未だ印刷できる量であると判断すると、ステップS6で1ページ分の印刷を行うとともにその印刷における駆動パルス数をカウントする。そしてステップS7では、1ページ分のカウントした駆動パルス数を、RAM内に格納される累積パルス数に加算することによりインク残量データを更新するとともに、同データをヘッド内のメモリ11に書き込む。なお、以上示した駆動パルス数のカウントは、具体的には、例えば駆動データの“オン”データを所定のカウンタによってカウントすることができる。また、回復処理の回数も同様に、処理を行うごとに所定のカウンタの内容をインクリメントすることによってカウントすることができる。次に、ステップS8で、ステップS2、S5と同様の残量チェックを行い、インク残量が未だ少なくなっていない場合には、ステップS9において、最終ページの記録が終了して記録終了か否かを判断し、終了していない場合はステップS6の処理に戻り同様の処理を繰り返し、終了したと判断した場合は本処理手順を終了する。

【0019】一方、ステップS2、S5およびS8のそれぞれで、残量が所定値以下で残量が少ないと判断した場合は、ステップS10において、プリンタの所定の表示部でインク残量が少ない旨の表示を行い、ステップS11でインクジェットユニットが交換されるのを待機する。新たなインクジェットユニットが装着されたことを検知すると、ステップS1の処理に戻り、ステップS1

以上の上述した処理を行う。

【0020】なお、以上の実施形態の説明において、プリンタの機械的構成等の説明を省略したが、以上で説明した以外の構成については公知のものをを用いることができることは勿論である。

【0021】また、上記実施形態においては、メモリ11を基板12に外付けで設けるようにしたが、例えばシリコン基板13に発熱抵抗体や電極等を形成するのと同様のプロセスでシリコン基板内に形成するようにしてもよい。

【0022】（その他）なお、本発明は、特にインクジェット記録方式の中でも、インク吐出を行わせるために利用されるエネルギーとして熱エネルギーを発生する手段（例えば電気熱変換体やレーザ光等）を備え、前記熱エネルギーによりインクの状態変化を生起させる方式の記録ヘッド、記録装置において優れた効果をもたらすものである。かかる方式によれば記録の高密度化、高精細化が達成できるからである。

【0023】その代表的な構成や原理については、例えば、米国特許第4723129号明細書、同第4740796号明細書に開示されている基本的な原理を用いて行うものが好ましい。この方式は所謂オンデマンド型、コンティニユアス型のいずれにも適用可能であるが、特に、オンデマンド型の場合には、液体（インク）が保持されているシートや液路に対応して配置されている電気熱変換体に、記録情報に対応して核沸騰を越える急速な温度上昇を与える少なくとも1つの駆動信号を印加することによって、電気熱変換体に熱エネルギーを発生せしめ、記録ヘッドの熱作用面に膜沸騰を生じさせて、結果的にこの駆動信号に一对一に対応した液体（インク）内の気泡を形成できるので有効である。この気泡の成長、収縮により吐出用開口を介して液体（インク）を吐出させて、少なくとも1つの滴を形成する。この駆動信号をパルス形状とすると、即時適切に気泡の成長収縮が行われるので、特に応答性に優れた液体（インク）の吐出が達成でき、より好ましい。このパルス形状の駆動信号としては、米国特許第4463359号明細書、同第4345262号明細書に記載されているようなものが適している。なお、上記熱作用面の温度上昇率に関する発明の米国特許第4313124号明細書に記載されている条件を採用すると、さらに優れた記録を行うことができる。

【0024】記録ヘッドの構成としては、上述の各明細書に開示されているような吐出口、液路、電気熱変換体の組合せ構成（直線状液流路または直角液流路）の他に熱作用部が屈曲する領域に配置されている構成を開示する米国特許第4558333号明細書、米国特許第4459600号明細書を用いた構成も本発明に含まれるものである。加えて、複数の電気熱変換体に対して、共通するスリットを電気熱変換体の吐出部とする構成を開示

する特開昭59-123670号公報や熱エネルギーの圧力波を吸収する開孔を吐出部に対応させる構成を開示する特開昭59-138461号公報に基いた構成としても本発明の効果は有効である。すなわち、記録ヘッドの形態がどのようなものであっても、本発明によれば記録を確実に効率よく行うことができるようになるからである。

【0025】さらに、記録装置が記録できる記録媒体の最大幅に対応した長さを有するフルラインタイプの記録ヘッドに対しても本発明は有効に適用できる。そのような記録ヘッドとしては、複数記録ヘッドの組合せによってその長さを満たす構成や、一体的に形成された1個の記録ヘッドとしての構成のいずれでもよい。

【0026】加えて、上例のようなシリアルタイプのものでも、装置本体に固定された記録ヘッド、あるいは装置本体に装着されることで装置本体との電気的な接続や装置本体からのインクの供給が可能になる交換自在のチップタイプの記録ヘッド、あるいは記録ヘッド自体に一体的にインクタンクが設けられたカートリッジタイプの記録ヘッドを用いた場合にも本発明は有効である。

【0027】また、本発明の記録装置の構成として、記録ヘッドの吐出回復手段、予備的な補助手段等を付加することは本発明の効果を一層安定できるので、好ましいものである。これらを具体的に挙げれば、記録ヘッドに対してのキャッピング手段、クリーニング手段、加圧或は吸引手段、電気熱変換体或はこれとは別の加熱素子或はこれらの組み合わせを用いて加熱を行う予備加熱手段、記録とは別の吐出を行なう予備吐出手段を挙げることができる。

【0028】また、搭載される記録ヘッドの種類ないし個数についても、例えば単色のインクに対応して1個のみが設けられたもの他、記録色や濃度を異にする複数のインクに対応して複数個数設けられるものであってもよい。すなわち、例えば記録装置の記録モードとしては黒色等の主流色のみの記録モードだけではなく、記録ヘッドを一体的に構成するか複数個の組み合わせによるかいずれでもよいが、異なる色の複色カラー、または混色によるフルカラーの各記録モードの少なくとも一つを備えた装置にも本発明は極めて有効である。

【0029】さらに加えて、以上説明した本発明実施例においては、インクを液体として説明しているが、室温やそれ以下で固化するインクであって、室温で軟化もしくは液化するものを用いてもよく、あるいはインクジェット方式ではインク自体を30℃以上70℃以下の範囲内で温度調整を行ってインクの粘性を安定吐出範囲にあるように温度制御するものが一般的であるから、使用記録信号付与時にインクが液状をなすものを用いてもよい。加えて、熱エネルギーによる昇温を、インクの固形状態から液体状態への状態変化のエネルギーとして使用せしめることで積極的に防止するため、またはインクの蒸発

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を防止するため、放置状態で固化し加熱によって液化するインクを用いてもよい。いずれにしても熱エネルギーの記録信号に応じた付与によってインクが液化し、液状インクが吐出されるものや、記録媒体に到達する時点ではすでに固化し始めるもの等のような、熱エネルギーの付与によって初めて液化する性質のインクを使用する場合も本発明は適用可能である。このような場合のインクは、特開昭54-56847号公報あるいは特開昭60-71260号公報に記載されるような、多孔質シート凹部または貫通孔に液状又は固形物として保持された状態で、電気熱変換体に対して対向するような形態としてもよい。本発明においては、上述した各インクに対して最も有効なものは、上述した膜沸騰方式を実行するものである。

【0030】さらに加えて、本発明インクジェット記録装置の形態としては、コンピュータ等の情報処理機器の画像出力端末として用いられるものの他、リーダーと組合せた複写装置、さらには送受信機能を有するファクシミリ装置の形態を採るもの等であってもよい。

【0031】

【発明の効果】以上の説明から明らかなように、本発明

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によれば、ヘッドが有するメモリに吐出回数等のインク消費に関するデータが格納されるので、このデータを読み取ることにより、インクタンクにおけるインクの残量に関する情報を得ることができる。

【0032】この結果、簡易かつ低コストな構成でインク残量検知を行うことができる。

【図面の簡単な説明】

【図1】インクタンクにおける従来のインク残量検知のための構成を示す模式図である。

10 【図2】図1に示す従来のインク残量検知のための構成の等価回路を示す図である。

【図3】本発明の一実施形態に係るインクジェットユニットの内部構成を模式的に示す図である。

【図4】本発明の一実施形態に係るインク残量検知処理を伴う記録動作の手順を示すフローチャートである。

【符号の説明】

10 ヘッド

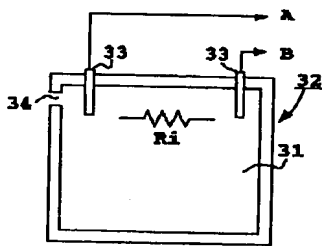
11 メモリ

12 PCB基板

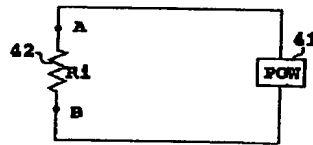
20 13 シリコン基板

14 インクタンク

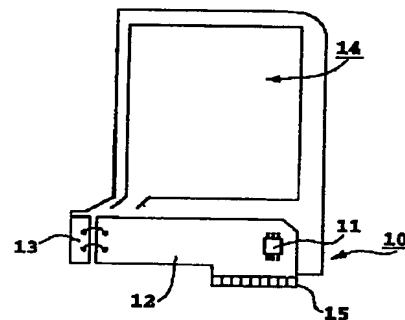
【図1】



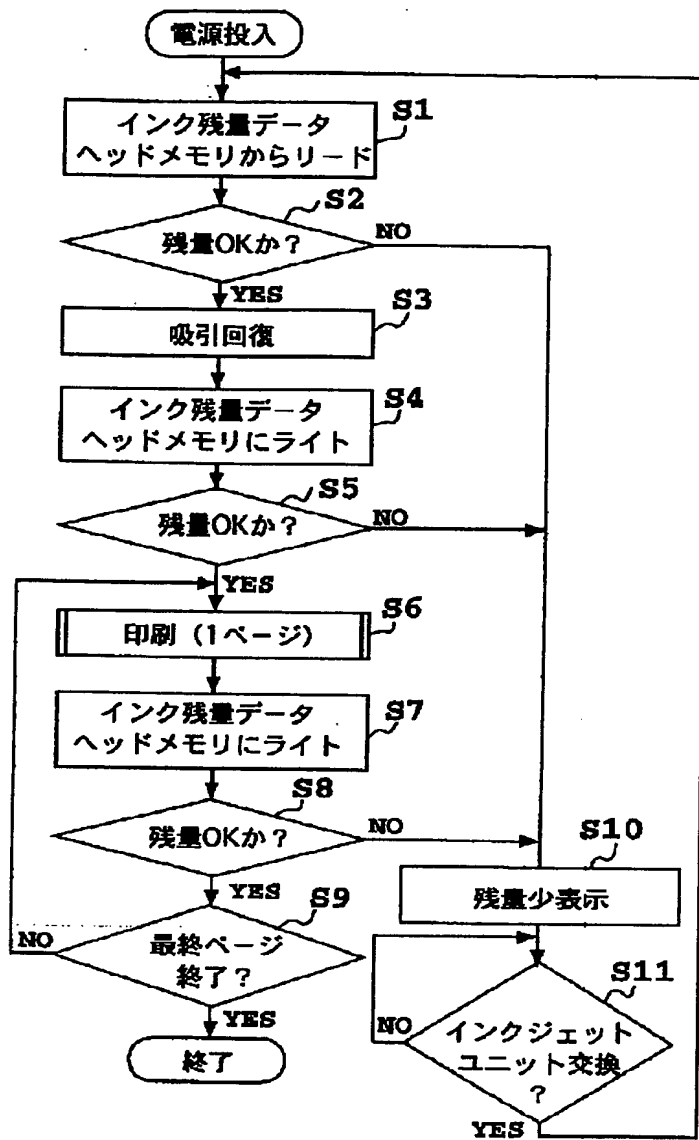
【図2】



【図3】



【図4】



## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-109431

(43)Date of publication of application : 28.04.1998

(51)Int.Cl.

B41J 2/175

B41J 2/045

B41J 2/055

(21)Application number : 08-267564

(71)Applicant : SEIKO EPSON CORP

(22)Date of filing : 08.10.1996

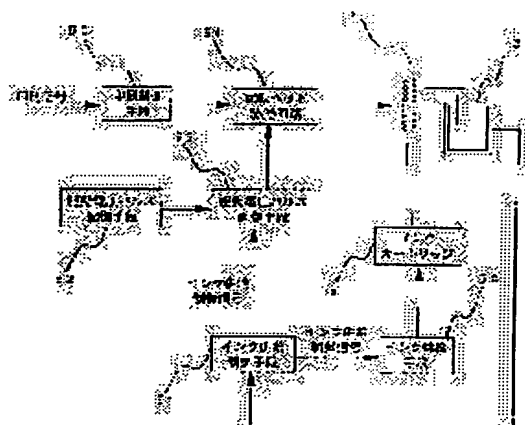
(72)Inventor : YONEKUBO SHUJI

## (54) INK JET TYPE RECORDING DEVICE

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To check the discharging characteristics of a recording head in charging irrespective of the reciprocatingly moving action between an ink cartridge and a sub-tank so as to improve print quality.

**SOLUTION:** In respectively response to two ink feeding states that a first process for supplying ink from an ink cartridge 6 through a recording head 8 to a sub-tank 10 and a second process for back-flowing the ink from the sub-tank 10 through the recording head 8 to the ink cartridge 6, a driving voltage pulse adjusting means 53 adjusts a driving voltage pulse condition for feeding to the recording head 8 optimally.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] An ink jet type recording head and a subtank equipped with the ink feed hopper by which ink flows into two common ink rooms which are open for free passage on both sides of a pressure generating room, and the ink room of said the community of each from the exterior, respectively are carried in carriage. Moreover, the ink cartridge which is open for free passage with said ink jet type recording head via passage out of said carriage, In the ink jet type recording device which comes to prepare an ink supply means to feed the ink of said ink cartridge to said ink jet type recording head The 1st process which is made to pass said recording head and supplements said subtank with ink from said ink cartridge, The ink supply control means which performs switch control with the 2nd process which is made to go via said recording head from said subtank, and flows backwards ink to said ink cartridge to said ink supply means, The ink jet type recording device characterized by having a driver voltage pulse adjustment means to adjust the driver voltage pulse supplied to said recording head based on the ink supply control signal from this ink supply control means.

[Claim 2] It is the ink jet type recording device according to claim 1 which said subtank possesses an ink residue detection means to detect the ink residue in a subtank, and is characterized by said driver voltage pulse adjustment means adjusting the driver voltage pulse supplied to said recording head corresponding to the ink supply control signal from the ink residue detected from this ink residue detection means, and said ink supply control means.

[Claim 3] Said subtank equips at least a part with a flexible film, and said ink residue detection means equips the location used as ink full with the piece of a corresponding movement following expansion of said flexible film. It is based on data. the time check from after counting of the number of pulse signals which makes the ink droplet from after said 1st process termination breathe out while detecting ink full by detection of migration of said piece of a corresponding movement, and said 1st process termination — The ink jet type recording device according to claim 2 characterized by detecting the ink residue condition in a subtank.

[Claim 4] It is the ink jet type recording device which sets they to be [ any / claim 1 thru/or / of 3 ], possesses a temperature detection means to detect surrounding ambient temperature further, and is characterized by said driver voltage pulse adjustment means adjusting further the driver voltage pulse supplied to said recording head according to the ambient temperature detected with said temperature detection means.

[Claim 5] Said driver voltage pulse adjustment means is an ink jet type recording device according to claim 1 to 4 characterized by adjusting said driver voltage pulse so that the amount of ink of the unit ink droplet in said 1st process and said 2nd process which carries out the regurgitation from said recording head may serve as abbreviation regularity.

[Claim 6] Said driver voltage pulse adjustment means is an ink jet type recording device according to claim 1 to 4 characterized by adjusting said driver voltage pulse so that the ink droplet rate of the ink droplet in said 1st process and said 2nd process which carries out the regurgitation from said recording head may serve as abbreviation regularity.

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[Translation done.]

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- 3.In the drawings, any words are not translated.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the ink jet type recording device which prints by supplying ink to a subtank and a recording head through passage from the ink cartridge which carried the ink jet type recording head and the subtank in carriage, and was installed in the box.

[0002]

[Description of the Prior Art] An ink jet type recording apparatus carrying in carriage the ink jet type recording head which carries out the regurgitation of the ink droplet with a pressure generating means, and it printing, receiving supply of ink from an ink cartridge, also carrying an ink cartridge in the carriage usually equipped with the recording head, and attaining simplification of structure is performed.

[0003] In order for dot density to become large by leaps and bounds with improvement in the engine performance of an ink jet type recording head, to, attain color printing with natural color on the other hand and to aim at improvement in much more printing quality, efforts to make the blot on a record medium small as much as possible are made.

[0004] Ink is made to contain an emulsion and sugar as the one means, and approaches, such as carrying out film formation of the ink droplet on a record medium, are proposed.

[0005] If it is in ink equipped with such film formation nature, since a possibility of barring the flow of the ink to a recording head by the porous body which is inevitably needed for the cartridge of an on-cartridge type is high, while a subtank is carried in carriage, the separation ink supply system which pumps up ink from the ink cartridge \*\*\*\*(ed) by the box, and supplies ink to a recording head through this subtank is proposed.

[0006] For example, while carrying a recording head and a subtank in carriage so that JP,4-43785,B may see, after connecting a subtank and the Main tank by the tube and pumping up new ink on a subtank, it is constituted so that ink may be supplied to a recording head from a subtank.

[0007] According to this, there is a merit which can lightweight-ize weight of the whole carriage and it not only can supply ink to a recording head directly, but can aim at high-speed printing and extension of the period of an ink supplement. However, it has the problem that the air bubbles generated within the subtank with the reciprocating motion of carriage on the other hand invade into a recording head, and check the regurgitation of ink.

[0008] In order to solve such a problem, connecting a recording head, a subtank, and an ink cartridge to endless, and circulating ink is also proposed. However, since two passage of the passage for outward trips and the passage for return trips is needed between a recording head and an ink cartridge, it has the problem that passage structure becomes complicated.

[0009] In order to solve such a problem, these people etc. The ink jet type recording head and subtank which equipped two common ink rooms which are open for free passage on both sides of a pressure generating room, and the ink room of each community with the ink feed hopper which connects with the exterior, respectively are carried in carriage. Moreover, out of carriage, an ink cartridge and an ink supply means to feed the ink of an ink cartridge intermittently to a recording head are established. The ink jet type recording device it was made to make as ink reciprocated

between an ink cartridge and a subtank by making a recording head into a relay point is proposed.

[0010]

[Problem(s) to be Solved by the Invention] According to this, thickening of the ink in the film formation and the subtank in a recording head can be prevented as much as possible, without causing complication of structure. however, \*\* [ in / on the time of a switch with the 1st process which is made to pass a recording head and supplements a subtank with ink from an ink cartridge in order to make, as ink reciprocates between an ink cartridge and a subtank by making a recording head into a relay point, and the 2nd process which is made to go via a recording head from a subtank, and flows backwards ink to an ink cartridge, and / the pressure generating room of a recording head ] — a static pressure will be changed frequently. For this reason, the regurgitation property of the ink droplet rate and the amount of ink droplets of an ink droplet which carry out the regurgitation from a recording head was changed frequently, and it is concentration nonuniformity or had the trouble that deterioration of the printing quality on a record medium called a color difference gap occurred, in color printing.

[0011]

[Means for Solving the Problem] In order to cancel such a trouble, it sets to this invention. An ink jet type recording head and a subtank equipped with the ink feed hopper by which ink flows into two common ink rooms which are open for free passage on both sides of a pressure generating room, and the ink room of said the community of each from the exterior, respectively are carried in carriage. Moreover, the ink cartridge which is open for free passage with said ink jet type recording head via passage out of said carriage, In the ink jet type recording device which comes to prepare an ink supply means to feed the ink of said ink cartridge to said ink jet type recording head The 1st process which is made to pass said recording head and supplements said subtank with ink from said ink cartridge, The ink supply control means which performs switch control with the 2nd process which is made to go via said recording head from said subtank, and flows backwards ink to said ink cartridge to said ink supply means, It had a driver voltage pulse adjustment means to adjust the driver voltage pulse supplied to said recording head based on the ink supply control signal from this ink supply control means.

[0012]

[Function] By adjusting the driver voltage pulse supplied to a recording head corresponding to reciprocation actuation of ink, automatic amendment of the frequent pressure fluctuation of the pressure generating room caused by the actuation which makes ink reciprocate between an ink cartridge and a subtank is carried out, and the effect by said pressure fluctuation of the regurgitation property of a recording head is suppressed.

[0013]

[Embodiment of the Invention] Then, based on the example illustrating the detail of this invention, it explains below.

[0014] (The 1st example) Drawing 1 thru/or drawing 10 explain the 1st example of this invention.

[0015] Drawing 1 shows one example of the ink jet type recording apparatus by this invention, and the sign 1 in drawing is carriage, and it is constituted so that both-way migration may be carried out in parallel with the revolving shaft 5 of a platen 4 which it is supported by the guide members 2 and 3 and is mentioned later. The recording head 8 which carries out direct continuation to the ink cartridge 6 prepared in the box with the ink tube 7, and the subtank 10 which connects with a recording head 8 with a tube 9, and collects ink are carried in carriage 1. Moreover, the \*\* ink tank 17 which holds a capping means to close in contact with a recording head 8, and the ink discharged from the recording head 8 is formed in the non-printing area.

[0016] It is the above-mentioned platen, 4 holds the record form taken out from the paper tray 11 with the pickup roller 12 on a front face by the claw part material 13, and it is constituted, drying ink at the built-in heater so that the delivery opening 14 may be made to discharge, while catching the ink droplet from a recording head 8 in a record form and making a dot form.

[0017] 6 is the above-mentioned ink cartridge, and an ink supply needle is inserted by the lever 15 operational [ from ] outside a box 18, and it can supply ink now to a recording head 8 through

the ink tube 7 which is the passage linked to this needle. In addition, the sign 19 in drawing shows a ventilating fan.

[0018] Drawing 2 , drawing 3 , drawing 4 , and drawing 5 show one example of the ink jet type recording head 8 mentioned above, respectively, it is a nozzle plate, and two or more nozzle orifices 21 are drilled, and the sign 20 in drawing serves as a member which closes one field of the spacer 22 mentioned later. Septa 23 and 23 and 23 .. are formed at equal intervals, 22 forms nozzle orifices 21 and 21, the pressure generating rooms 24 and 24 which are open for free passage to 21 .., and 24 .. so that the nozzle orifices 21 and 21 and 21 .... which are a spacer and adjoin may be separated, it is a nozzle plate about one field, and the closure of the field of another side is carried out with the diaphragm 25.

[0019] It is prepared so that the pressure generating rooms 24 and 24 and the common ink rooms 26 and 27 of 24 .... as shown in both sides at drawing 2 and drawing 3 may be open for free passage in the pressure generating room 24, and the common ink of another side can be moved now via the pressure generating rooms 24 and 24 and 24 .. from one common ink room 26.

[0020] Moreover, as shown in drawing 5 , the 1st ink feed hopper 30 connected to an ink cartridge 6 through the ink tube 7 and the 2nd ink feed hopper 31 linked to the subtank 10 are formed in the common ink rooms 26 and 27.

[0021] It returns to drawing 2 again, and the sign 28 in drawing is a piezoelectric device, the laminating of an electrode and the piezo-electric oscillating ingredient is carried out on sandwiches, it is constituted so that vibration with longitudinal-oscillation mode may be generated, the same number and its tip are contacted [ .... / nozzle orifices 21 and 21 and / 21 ] with a diaphragm 25, and the other end is being fixed to the pedestal 29. It elongates by the driver voltage pulse based on a printing signal, and a piezoelectric device 28 makes an ink droplet breathe out from a nozzle orifice 21.

[0022] Drawing 6 shows the outline of the ink supply system of the ink jet type recording apparatus mentioned above, and the subtank 10 carried in the ink bag 41 with which the 1st ink feed hopper 30 of the recording head 8 carried in carriage 1 is held in the ink cartridge 6 with the ink tube 7 the same again at carriage 1 is connected to the 2nd ink feed hopper 31 of a recording head 8.

[0023] The ink bag 41 is compressed by ink supply means to pressurize the airtight space 44 of a cartridge 6 with air from an air pump 42 by such configuration at this example where a nozzle orifice 21 is closed with a capping means etc., and ink flows into the 1st feed hopper 30 of a recording head 8 via the ink tube 7.

[0024] Ink passes through the pressure generating room 24 from one common ink room 26, and flows into the common ink room 27 of another side. The ink which flowed into the common ink room 27 passes the 2nd ink feed hopper 31, and flows into the subtank 10.

[0025] The air bubbles which remain in the common ink rooms 26 and 27 or the pressure generating room 24 in this process, and the ink in which concentration became high by about 21 nozzle orifice again are discharged by the subtank 10, and a nozzle orifice 21 and the pressure generating room 24 are washed in the new ink from an ink cartridge 6.

[0026] If a supplement of ink on the subtank 10 progresses and the pressure of the space of the subtank 10 rises, only air will be emitted to atmospheric air from the bulb 47 for air-bleeders. If the subtank 10 is filled up with the ink of the specified quantity, a signal will output from the ink full sensor 45 mentioned later, and an air pump 42 will stop, and the bulb 47 for air-bleeders will also be closed.

[0027] Then, the ink of the subtank 10 flows into a recording head 8 according to the water head difference based on the difference of elevation of carriage 1 and a cartridge 6, and flows backwards to an ink cartridge 6 further.

[0028] If the back flow to an ink cartridge 6 progresses and the amount of ink of the subtank 10 decreases, a signal will output from the ink empty sensor 46 mentioned later. An air pump 42 operates by this, ink is fed from an ink cartridge 6, and the same process as the above-mentioned is repeated.

[0029] Thus, while both-way circulation with the subtank 10 and ink cartridge 6 which went via

the recording head 8 is repeated and new ink washes the pressure generating room 24, the common ink rooms 26 and 27, and nozzle orifice 21 of a recording head 8, the viscosity of ink is maintained to a uniform value.

[0030] Drawing 7 shows one example of the subtank of the above-mentioned ink jet type recording apparatus, and it is a base, and the sign 60 in drawing forms in one the 3rd rib 63 prolonged in the production top of the closure section 65 which welds opening of the bag body 70 mentioned later, a rib 61, a rib 62, the 2nd ink feed hopper 31 of a recording head 8, and the end connection 64 open for free passage with injection molding of polymeric materials etc., and is constituted.

[0031] Furthermore, the above-mentioned bulb 47 for air-bleeders is arranged above this closure section 65, and through-hole 63a which an end punctures to an end connection 64, and the other end punctures at a tip is drilled by the 3rd rib 63.

[0032] With the bag body, 70 bends a \*\* type-like high polymer film with a center line, welds three-side 70a other than upside opening, and 70b and 70c, and is formed. And the closure section 65 was inserted in opening formed in other one side of a bag body 70, and it has fixed to the base 60 so that it may weld around the closure section 65 and airtightness may be secured.

[0033] In this example, if ink is fed from an ink cartridge 6, ink will be extruded by the bag body 70 through an end connection 64. If the bag body 70 expands with the inflow of ink and it fills up with the ink of the amount of conventions, the piece of a corresponding movement which is not illustrated will move outside greatly following the swelling of a bag body 70, the signal of ink full will output from the ink full sensor 45, and liquid sending of ink will be stopped.

[0034] Then, according to the water head difference based on the difference of elevation of carriage 1 and a cartridge 6, the ink in a bag body 70 flows into a recording head 8 from the lower limit of through-hole 63b currently formed in the 3rd rib 63, and flows backwards to an ink cartridge 6 further. If a back flow advances and the ink in a bag body 70 approaches the amount of ink empty conventions, it will fade in the shape of [ which makes the upper part a base in accordance with the configuration of ribs 61, 62, and 63 ] a triangle. The ink empty sensor 46 which consisted of quantity of light detectors detects the passage quantity of light which increases rapidly because the lower field of a bag body 70 sticks as ink empty, and outputs a signal. An air pump 42 operates by this, ink is fed from an ink cartridge 6, and the same process as the above-mentioned is repeated.

[0035] Drawing 8 is the block diagram showing one example of this invention. In this example, the wave of the driver voltage pulse supplied to a recording head 8 between an ink cartridge 6 and the subtank 10 corresponding to the actuation which makes ink reciprocate is made adjustable. The configuration for adjusting a driver voltage pulse according to the block diagram of drawing 8 is explained.

[0036] The sign 50 in drawing is an ink supply means, and based on the ink supply control signal from the ink supply control means 51 mentioned later, it pressurizes the airtight space 44 of a cartridge 6 with air from an air pump 42, and it is constituted so that ink may be supplied to a recording head 8 and the subtank 10.

[0037] 51 is the above-mentioned ink supply control means, and outputs an ink supply control signal to the ink supply means 50 corresponding to the condition of the amount of ink in the subtank 10 detected from the ink full sensor 45 and the ink empty sensor 46. It is constituted so that an ink supply control signal may be outputted also to a driver voltage pulse adjustment means 53 to mention later to it and coincidence.

[0038] The 1st process which 52 is a driver voltage pulse storage means, and supplements the subtank 10 with ink via a recording head 8 from an ink cartridge 6 with the ink supply means 50, As opposed to two ink supply conditions of the 2nd process which is made to go via a recording head 8 from the subtank 10, and flows backwards ink to an ink cartridge 6 The data which specify the optimal driver voltage pulse conditions which are needed for obtaining the optimal printing result, and which are investigated beforehand and determined are stored, and it is constituted.

[0039] 53 is the above-mentioned driver voltage pulse adjustment means, and based on the ink supply control signal inputted from the ink supply control means 51, it reads the optimal driver

voltage pulse conditions from the driver voltage pulse storage means 52, and it sets up this driver voltage pulse condition so that it may become the output of the recording head drive circuit 54.

[0040] In addition, the sign 55 in drawing shows the printing control means which controls the recording head drive circuit 54 based on the printing signal from an external device.

[0041] Next, it does in this way and the regurgitation property of the ink droplet of the constituted equipment is explained using drawing 9 and drawing 10. Drawing 9 is the diagram showing the relation between the ink residue of a subtank, and the ink droplet weight of a regurgitation ink droplet. Drawing 10 is the diagram showing the wave of the driver voltage pulse impressed to a recording head.

[0042] First, as shown in (a) in drawing 10, when a driver voltage pulse is set constant regardless of the ink round trip actuation between an ink cartridge 6 and the subtank 10, the relation between the ink residue of the subtank 10 and the ink droplet weight of a regurgitation ink droplet comes to be shown in drawing 9 (a). In the 1st process which is feeding ink on the subtank, supply of ink is smoothly made by the pressurization from an air pump 42 at the pressure generating room 24 from an ink cartridge 6. If the amount of ink of the subtank 10 reaches the ink full set point, from the ink full sensor 45, a signal will output, an air pump 42 will be stopped and ink feeding will stop. The pressure which takes for the pressure generating room 24 at this time declines by the pressure by ink feeding, the regurgitation property of a recording head 8 changes and ink droplet weight falls. The remainder flows backwards to an ink cartridge 6 according to the water head difference based on [ in the 2nd process which ink feeding has stopped, as for the ink in the subtank 10, a part is breathed out as an ink droplet from a recording head 8, and also ] the difference of elevation of carriage 1 and an ink cartridge 6. The ink serviceability from the subtank 10 declines as the amount of ink in the subtank 10 approaches the ink empty set point, and ink droplet weight falls further. If the amount of ink in the subtank 10 reaches the ink empty set point at last, from the ink empty sensor 46, a signal will output, an air pump 42 will be operated and ink feeding will begin. It goes up by the pressure by ink feeding, the regurgitation property of a recording head 8 changes, and ink droplet weight increases the pressure which takes for the pressure generating room 24 at this time. Thus, if ink round trip actuation between an ink cartridge 6 and the subtank 10 is performed, the ink droplet weight difference in the 1st process and the 2nd process will occur.

[0043] As [ in (b) in drawing 10, and the 2nd process ] shown in (c) in drawing 10, when driver voltage is made adjustable at the 1st process corresponding to the ink round trip actuation between an ink cartridge 6 and the subtank 10, the relation between the ink residue of the subtank 10 and the ink droplet weight of a regurgitation ink droplet comes to be shown in drawing 9 (b). Then, in this invention, at the 1st process out of which ink droplet weight tends to come, the driver voltage pulse adjustment means 53 sets driver voltage as (b) lower than (a) in drawing 10, and sets driver voltage as (c) higher than (a) in drawing 10 by the 2nd process out of which ink droplet weight cannot come easily conversely. Thereby, it does not depend on the ink round trip actuation between an ink cartridge 6 and the subtank 10, but the ink droplet weight difference in the 1st process and the 2nd process becomes small.

[0044] In this example, by making driver voltage adjustable to the recording head drive circuit 54, the driver voltage pulse adjustment means 53 adjusted so that the amount of ink of the unit ink droplet in the 1st process and the 2nd process might serve as abbreviation regularity. even making pulse duration of a driver voltage pulse adjustable to the recording head drive circuit 54 apart from this — the amount of ink of the unit ink droplet in the 1st process and the 2nd process — abbreviation — adjusting so that it may become fixed is possible — carrying out — a pulse — the ink droplet rate of the regurgitation ink droplet in the 1st process and the 2nd process — abbreviation — adjusting so that it may become fixed is also possible.

[0045] (The 2nd example) The 2nd example is proportionate to said configuration, and drawing 11 is the block diagram showing the 2nd example of this invention. The point that the 2nd example differs from the 1st example is a point that detect the ink residue in the subtank 10 with the ink residue detection means 80, and the driver voltage pulse adjustment means 53 sets up a driver voltage pulse corresponding to two parameters called the ink supply control signal from this ink

residue value and the ink supply control means 51.

[0046] 80 is an ink residue detection means and detects the ink residue in the subtank 10. the pulse signal later mentioned after the ink residue detection means 80 of this example detects ink full by the ink full sensor 45 in the 2nd process which is made to go via a recording head 8 from the subtank 10, and flows backwards ink to an ink cartridge 6 — counting — based on counting of the number of pulse signals which makes the ink droplet from a means 81 breathe out, the amount of ink consumed by the regurgitation of an ink droplet is computed by the operation. moreover, the time check which mentions the ink residue detection means 80 later — the amount of ink which carried out the natural back flow to the ink cartridge 6 is computed from the subtank 10 after detecting ink full based on the time amount which has passed after detecting the ink full clocked by the means 82. The ink residue of the subtank 10 is calculated as a value which subtracted the amount of ink which flowed backwards to the amount of ink consumed by the regurgitation of an ink droplet from the ink residue of ink full known beforehand, and the ink cartridge 6.

[0047] On the contrary, it sets at the 1st process which supplements the subtank 10 with ink via a recording head 8 from an ink cartridge 6 with the ink supply means 50. The amount of feeding ink per unit time amount from the ink cartridge 6 currently investigated beforehand to the subtank 10, the time check mentioned later — based on the time amount which has passed after starting ink feeding clocked by the means 82, the total amount of ink fed to a recording head 8 and the subtank 10 after starting ink feeding is calculated. The ink residue of the subtank 10 is calculated by the ink residue detection means 80 as a value which subtracted the amount of ink consumed by the regurgitation of an ink droplet from the sum of this fed total amount of ink, and the ink residue of the subtank 10 at the time of initiation of ink feeding.

[0048] The ink residue detection means 80 of this example has the description that an ink residue is correctly detectable with a simple configuration, compared with the method which detects an ink residue mechanically or electrically. Moreover, as compared with the 1st example, even if there is no ink empty sensor 46 of the subtank 10, it has the description that ink empty is detectable.

[0049] 81 — a pulse signal — counting — it is a means, and the number of pulse signals which makes an ink droplet breathe out to the signal from the printing control means 55 is counted, and this counting is passed to the ink residue detection means 80.

[0050] Are a means and it is based on a signal from the ink supply control means 51. 82 — a time check — whenever [ which changes an ink supply control signal ] — a former time check — the time amount which has passed after resetting data and starting ink feeding — or \*\*\*\*\* of time amount which has passed after detecting the ink full of the subtank 10 is clocked, and it is constituted so that the timer means formed in the body of a recording apparatus and the time-of-day data inputted from host equipment again may be acquired and wearing duration may be calculated.

[0051] In this example, to two parameters called two ink supply conditions of the 1st process and the 2nd process which become clear with an ink supply control signal, and the ink residue in the subtank 10, the driver voltage pulse storage means 52 is investigated beforehand, stores the data which specify the optimal driver voltage pulse conditions determined, and is constituted.

[0052] Based on the ink residue in the subtank 10 inputted from the ink supply control signal and the ink residue detection means 80 which were inputted from the ink supply control means 51, the driver voltage pulse adjustment means 53 reads the optimal driver voltage pulse conditions from the driver voltage pulse storage means 52, and it sets up this driver voltage pulse condition so that it may become the output of the recording head drive circuit 54.

[0053] Since the effect not only an ink supply condition but the ink residue in the subtank 10 affects the regurgitation property of a recording head 8 can be amended as compared with the 1st example according to this example as stated above, the ink residue in the subtank 10 is not caused how, but it has the effectiveness that a uniform regurgitation property is acquired.

[0054] (The 3rd example) In this example, it differs in that input the detection data of surrounding ambient temperature into the driver voltage pulse adjustment means 53, consider the temperature dependence of ink viscosity to the 1st above-mentioned example or the 2nd



above-mentioned example, and a driver voltage pulse is adjusted further.

[0055] Drawing 12 is the block diagram showing this example applied to the 1st example. The temperature data measured with the temperature sensor 90 which is a temperature detection means are incorporated by the driver voltage pulse adjustment means 53 through A-D converter 91.

[0056] With the driver voltage pulse adjustment means 53, based on the temperature data inputted as the ink supply control signal from the ink supply control means 51 from the temperature sensor 90, the driver voltage pulse conditions which are beforehand investigated by the driver voltage pulse adjustment means 52, and are memorized are said to read-out, and the driver voltage pulse conditions of having taken into consideration the ambient temperature around a recording device in the recording head drive circuit 54 are set up.

[0057]

[Effect of the Invention] The 1st process which according to this invention is made to pass a recording head and supplements a subtank with ink from an ink cartridge as explained above, Two ink supply conditions of the 2nd process which is made to go via a recording head from a subtank, and flows backwards ink to an ink cartridge are embraced, respectively. Since the driver voltage pulse conditions which a driver voltage pulse adjustment means supplies to a recording head were adjusted to adjustable Automatic amendment of the effect of the expulsion-of-an-ink-droplet property on the frequent pressure fluctuation in the pressure generating room caused by the actuation which makes ink reciprocate between an ink cartridge and a subtank is carried out, and fluctuation of the regurgitation property of a recording head is suppressed. Consequently, it is concentration nonuniformity or the ink jet type recording device of an ink circuit system without deterioration of the printing quality on a record medium called a color difference gap can be realized in color printing.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the block diagram showing one example of the ink jet type recording device of this invention.

**[Drawing 2]** It is drawing showing one example of the ink jet type recording head used for equipment same as the above with the structure of the cross section in a horizontal direction.

**[Drawing 3]** It is the front view in which removing a nozzle plate and showing one example of the ink jet type recording head used for equipment same as the above with relation with a nozzle orifice.

**[Drawing 4]** It is drawing showing one example of the ink jet type recording head used for equipment same as the above with the structure of the longitudinal section in the axis which passes along a nozzle orifice.

**[Drawing 5]** In the ink jet type recording head used for equipment same as the above, it is the top view showing one example of the spacer which forms a common ink room.

**[Drawing 6]** It is drawing showing the outline of the ink supply system of this invention.

**[Drawing 7]** It is drawing showing one example of the subtank of the ink jet type recording apparatus of this invention.

**[Drawing 8]** It is the block diagram showing the 1st example of this invention.

**[Drawing 9]** It is the diagram showing the relation between the ink residue of a subtank, and the ink droplet weight of a regurgitation ink droplet.

**[Drawing 10]** It is the diagram showing the wave of the driver voltage pulse impressed to a recording head.

**[Drawing 11]** It is the block diagram showing the 2nd example of this invention.

**[Drawing 12]** It is the block diagram showing the 3rd example of this invention.

**[Description of Notations]**

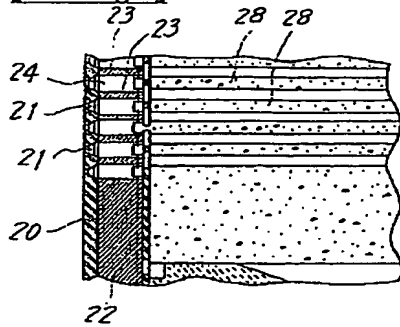
- 1 Carriage
- 6 Ink Cartridge
- 8 Recording Head
- 10 SubTank
- 45 Ink Full Sensor
- 50 Ink Supply Means
- 51 Ink Supply Control Means
- 52 Driver Voltage Pulse Storage Means
- 53 Driver Voltage Pulse Adjustment Means
- 54 Recording Head Drive Circuit
- 55 Printing Control Means
- 80 Ink Residue Detection Means
- 81 Pulse Signal — Counting — Means
- 82 Time Check — Means

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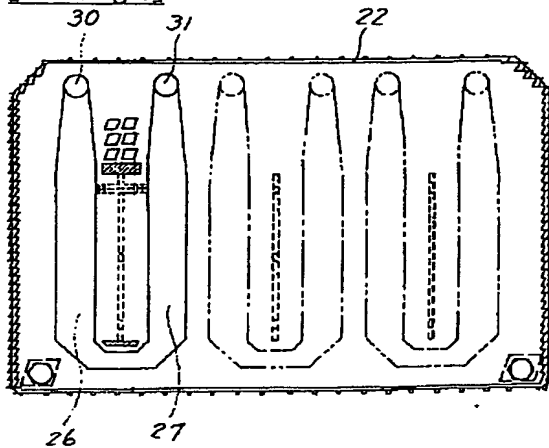
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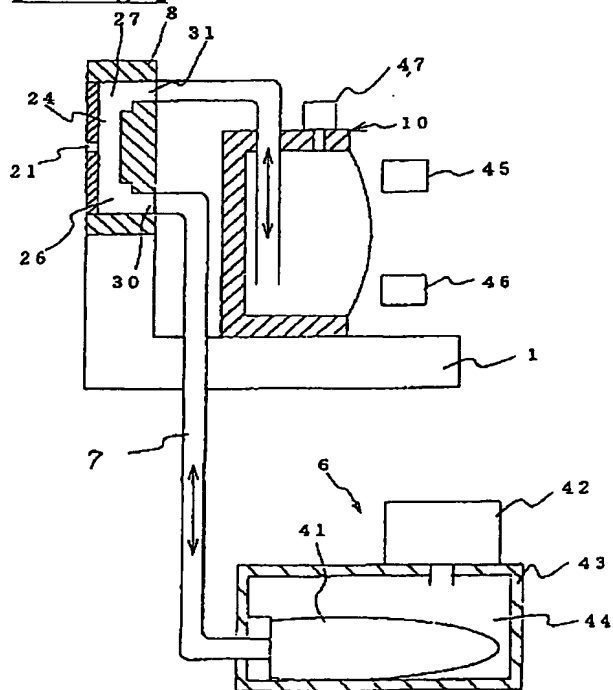
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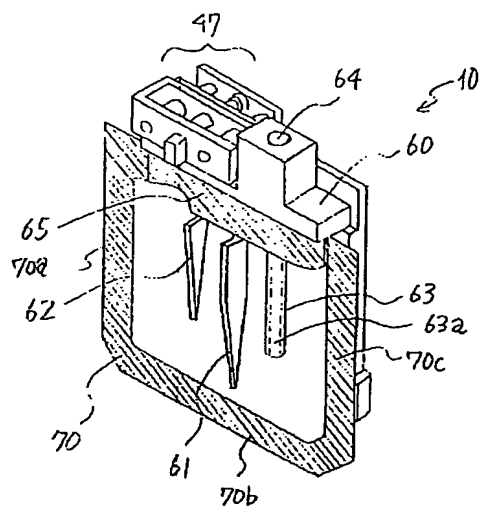
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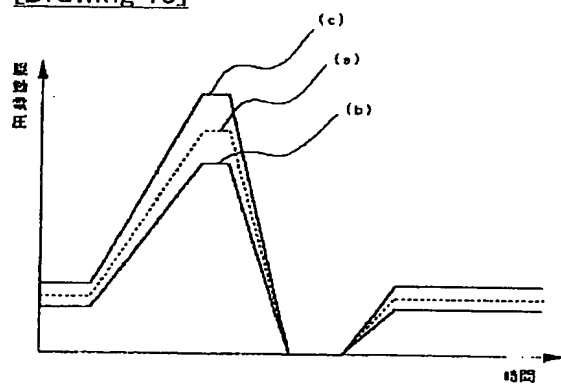
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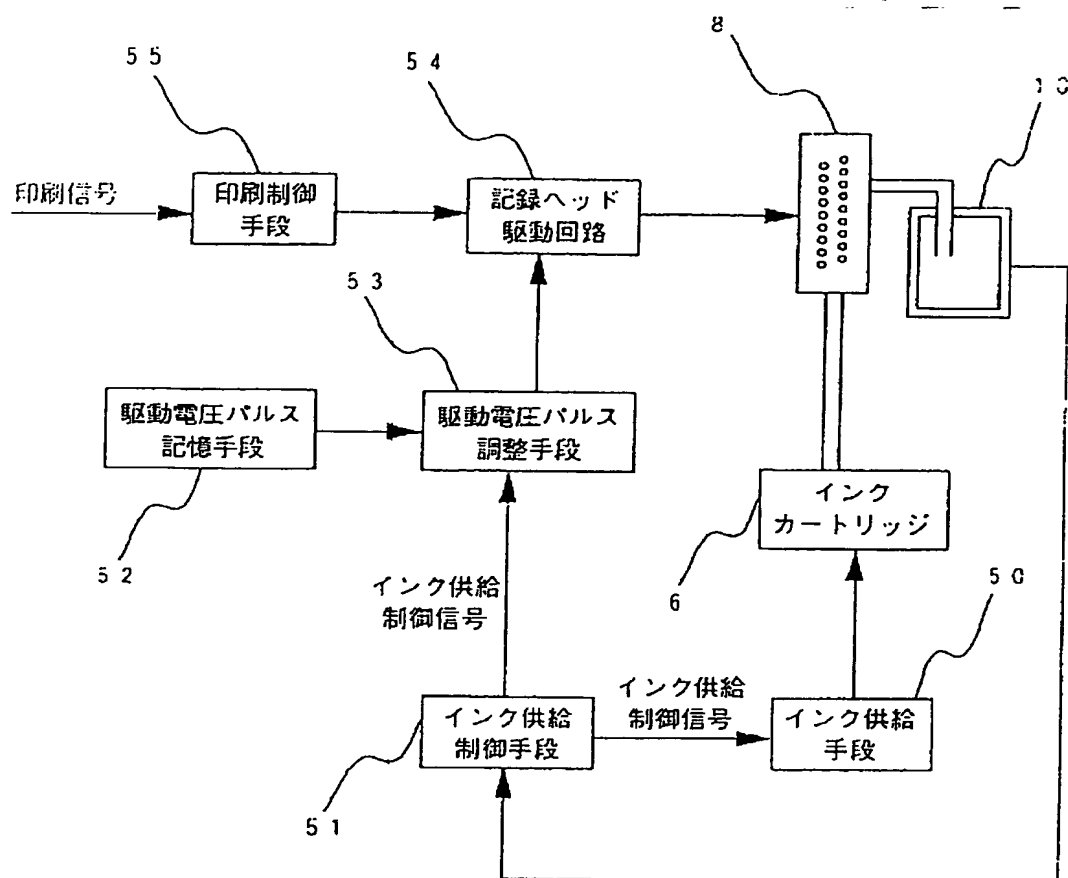
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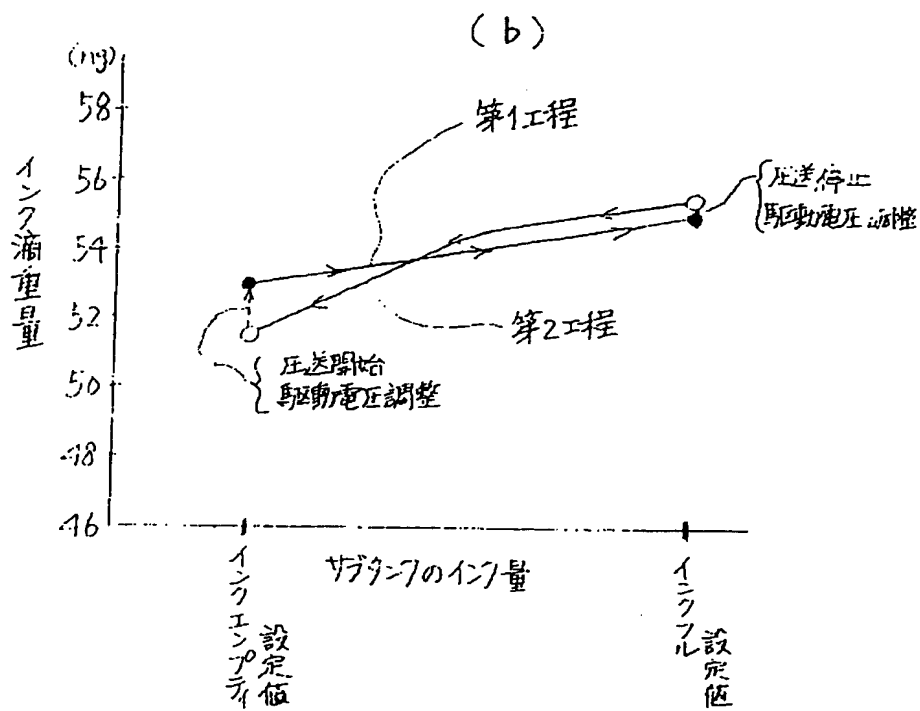
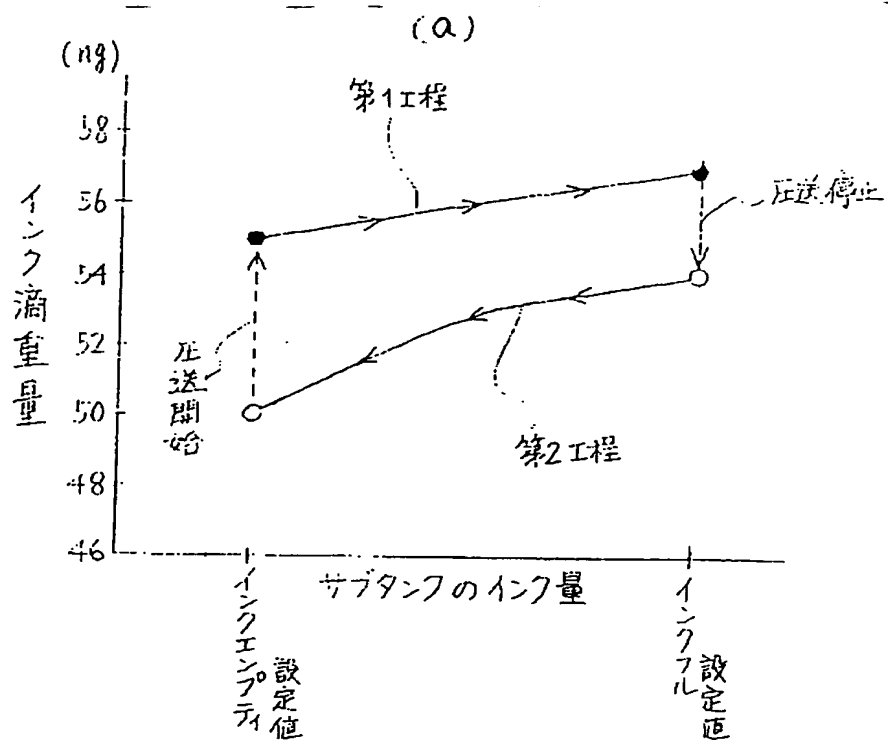
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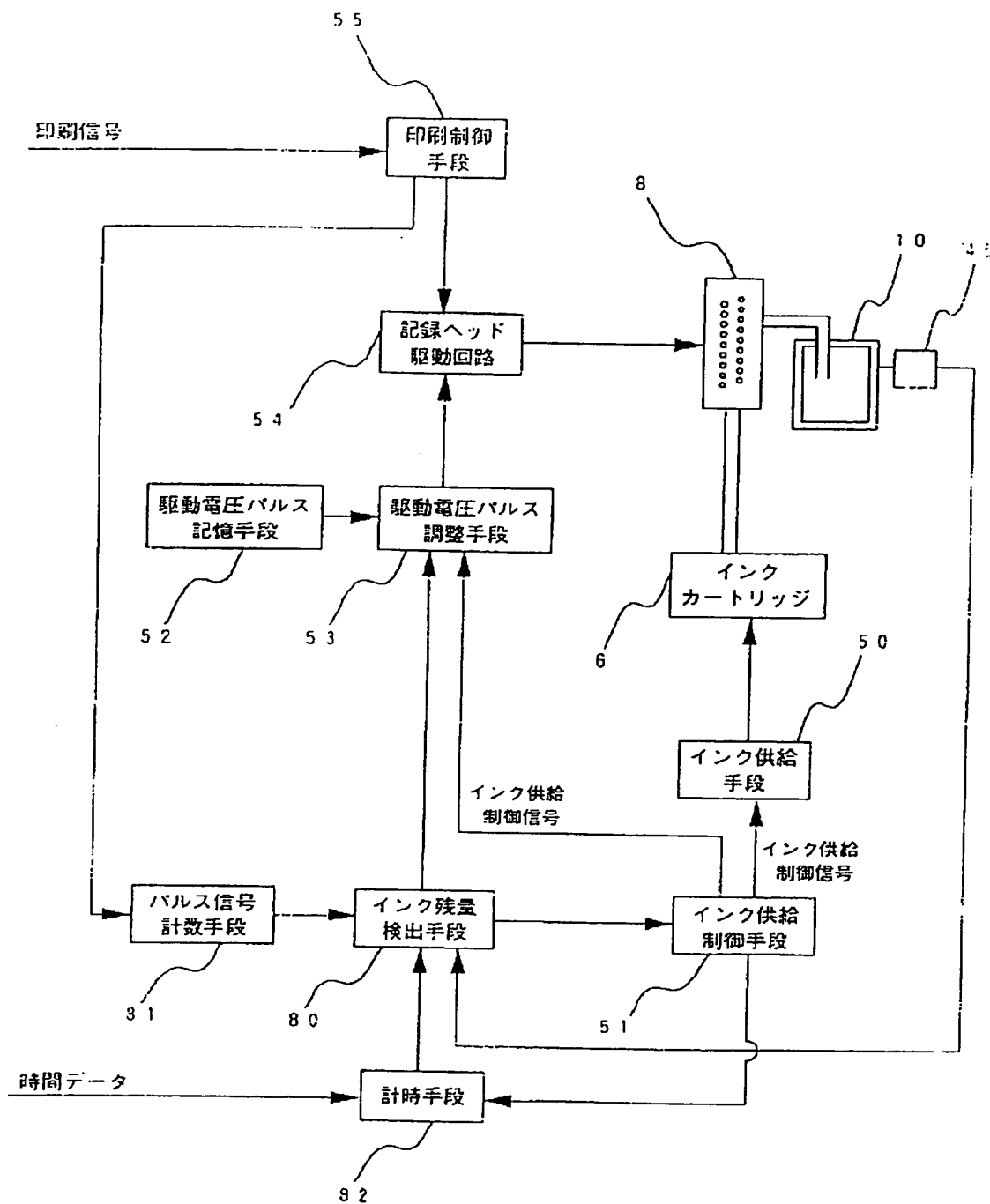
[Drawing 8]



[Drawing 9]

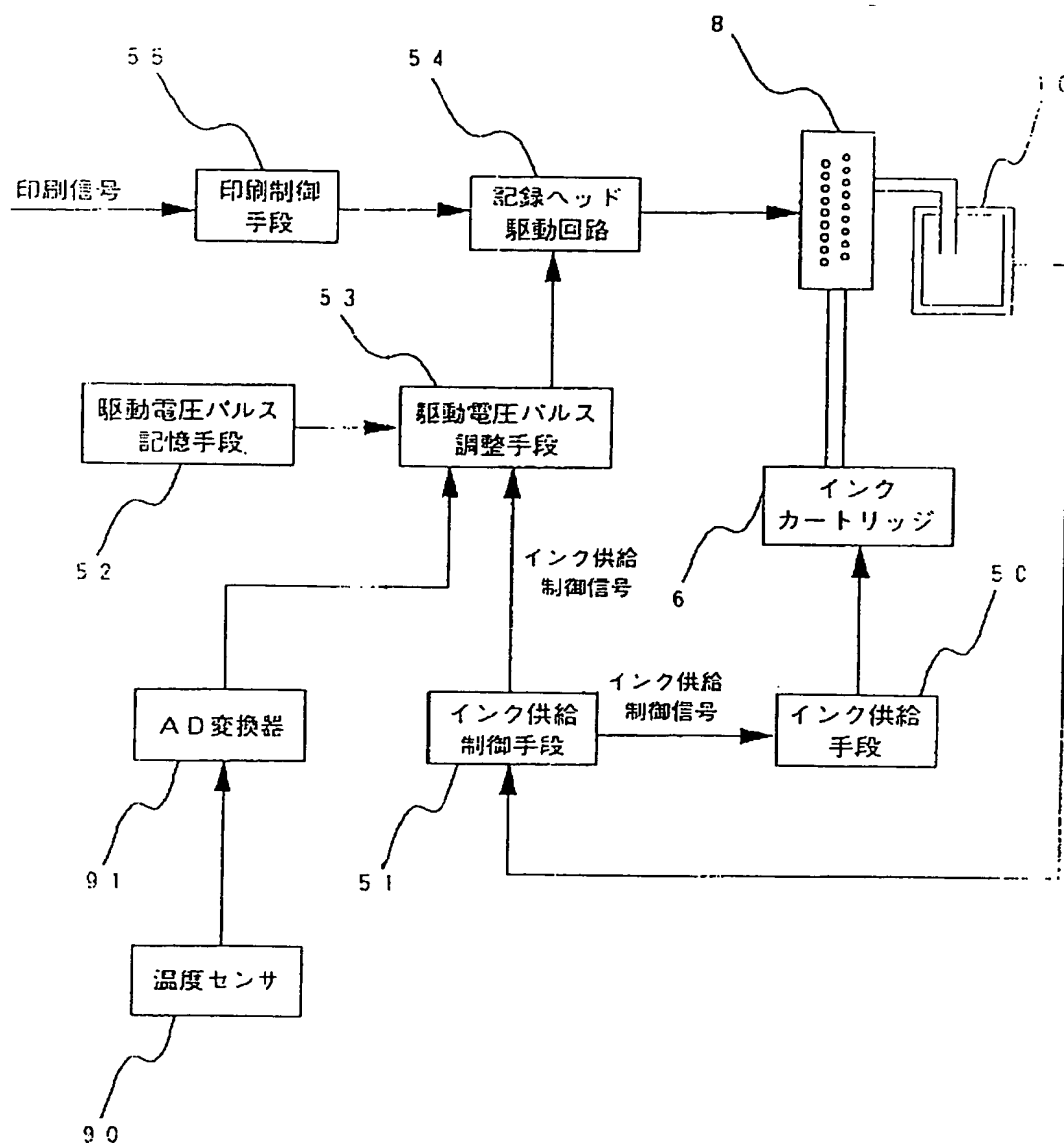


[Drawing 11]



[Drawing 12]





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